Journal of the Society of Arts.

FRIDAY, NOVEMBER 24, 1854.

IMPROVEMENTS IN PROGRESS IN PARIS.

The Committee appointed to consider and report on this subject held their first meeting on Tuesday, the 21st instant. Present: H. T. Hope, Esq., in the chair; Mr. Ashton, Mr. J. B. Bunning, Mr. E. Chadwick, C.B., Mr. H. Cole, Mr. Lewis Cubitt, Mr. G. Godwin, F.R.S., Sir Hector Greig, G.C.B., Mr. S. Redgrave, and Mr. Tite, F.R.S.

The Committee proceeded to arrange the course of proceedings to be adopted. It was said that in the carrying out improvements in Paris there was not only no loss, but that profit actually accrued; whilst, on the contrary, in London, it was admitted by all the members of the Committee, such improvements are always calculated to entail a loss of one-third their cost.

It was the general opinion of the Committee that this heavy cost was due in a very great measure to the very costly and inefficient modes of procedure in this country for the compulsorily obtaining possession of houses, lands, &c., for the purpose of public improvements; and numerous instances were cited exemplifying the monstrous results of the English system. The Committee considered it to be most desirable to obtain, in the first instance, authentic data as to how these matters are managed in France, and with what results as to cost, &c., with a view, if such results should appear favourable, to ascertain how far the French system, or any portion of it, consistently with the habits of the people of this country, could be introduced into our system.

The Committee instructed the Secretary to enter into communication with the municipal authorities in Paris, to endeavour to obtain from them particulars as to the mode of procedure for compulsorily obtaining possession of property for public improvements, with such details as to the practical working of the system there, in reference to the cost of making them, as will enable a comparison to be made between that and the system in operation here.

VISITS OF ARTIZANS TO PARIS.

This Committee met on Friday the 17th inst. Present, Viscount Ebrington, in the chair, Mr. George Clark and Mr. T. Twining, jun. The Committee proposes that a card shall be issued by the Society, under certain conditions, entitling the bearer to such privileges as the Railway and Steam-boat Companies may be disposed to grant to these excursionists, and to the benefits of the arrangements the Committee may make for the boarding and lodging of the excursionists, and of interpreter guides, &c., such card to serve also as a passport to the holder, and as a ticket of admission to public buildings, galleries, &c. in Paris. The Committee are taking steps to obtain from the French government the recognition of this card as a passport, and to obtain for the holder ready access to the sights of Paris. The Committee has reason to believe that the Railway and Steam-boat Companies are inclined to deal liberally with the excursionists. The Committee is engaged in completing the arrangements for ensuring to the excursionists comfortable board and lodging. This the Committee has little doubt of obtaining, for the ten days proposed for the excursion, at a cost not exceeding two pounds, and possibly it may be less. This will include not only the board and lodging, but all the services of agents on arrival in France and Paris, and of interpreter guides during the stay.

To this will have to be added the cost of travelling to Paris and back, and the Committee from communications they have received, have no reason to doubt but that the Railway and Steam-boat Companies are disposed to act liberally on the occasion, and make a very considerable reduction on the ordinary rates of fare in favour of these parties.

SECOND ORDINARY MEETING.

Wednesday, November 22, 1854.

The Second Ordinary Meeting of the One Hundred and First Session, was held on Wednesday, the 22nd instant, Dr. Lyon Playfair, C.B., F.R.S., Vice-President, in the chair.

The following Candidate was balloted for, and duly elected:—

Kennedy, James.

The following Institution has been taken into Union since the last announcement:—

380. London, Great Western Railway Literary Society

The Paper read was

ON THE MANUFACTURE AND APPLICATION OF VARIOUS PRODUCTS OBTAINED FROM COAL (COAL-GAS EXCEPTED).

By Professor F. Crace Calvert, F.C.S., &c.

Mr. Crace Calvert commenced his paper by stating that there were two distinct theories by which the formation of coals was explained; and in consequence of the geological influences to which they had been submitted, the coals presented great differences in their composition; as, for example, some were entirely composed, as anthracite, of nearly pure carbon, whilst others contained but a small proportion of fixed carbon, and a large proportion of tarry substances or hydro-carbons; such, for example, as cannel, bog-head, and Albert coal, from New Brunswick, and this led Mr. Crace Calvert to divide coal into three distinct classes, having regard to the distinct applications which they received in manufactures: the first class being employed as fuel in generating steam; the second for making coke; and the third kind chiefly for pro-

ducing gas. The most valuable researches which had been published upon the composition of coals, and the relative value of different kinds, principally for generating steam, were published in a voluminous report of experimental investigations on coal for the steam navy, by Sir H. De la Beche and Dr. Lyon Playfair, and presented to the House of Commons, by Royal command. The results of those investigations exemplified that most valuable information might be obtained from scientific researches on the relative value of different kinds of this important fuel for generating steam in manufactories, the steam-navy, &c. In fact, the English navy had already derived great advantages from the elaborate researches of the scientific gentlemen before-mentioned, to whom, no doubt, was due the credit of anthracite coal being now extensively used by our large steamers in their voyages to the Cape and Australia. That great improvements were yet to be made in the construction of the apparatus for generating steam, and of economy in the use of particular kinds of fuel, was evident from the fact (mentioned in the report before alluded to) that the combustion of one pound weight of coal in the best-constructed boilers of the present day converted into steam only 10lbs. of water at a temperature of 212°, instead of 14½lbs., which was the quantity demonstrated to be practicable of realisation.

The following Table is an abstract of the researches contained in the report above-mentioned:—

ACTUAL AND THEORETICAL DUTY OF COALS.

	Practical. lbs. of Water converted into Steam at 212° by one lb. of Coal.	*Theoretical.* lbs. of Water at 212° converted into Steam-Coke left.	*Theoretical.* Total lbs. of Water converted into Steam by one lb. of Coal
Graigola	9.35	11.31	13.563
Anthracite	9.46	12.554	14.593
Pentrefelin. . . .	6.39	10.841	13.787
Powel's Duffryn . .	10.15	11.134	15.092
Three-qr. Rock vein.	8.84	7.081	13.106
Pontypool	7.47	8.144	14.295
Ebbw Vale . . .	10.21	10.441	15.635
Dalkeith Jewel Seam	7.08	6.239	12.313
Fordel Splint . . .	7.56	6.56	13.817
Broomhill	7.30	7.711	14.863
Slievardagh (Irish) .	9.85	10.895	12.482

Another fact ascertained by the researches and experiments of the same gentlemen was that certain kinds of coal were superior for generating steam rapidly, by their quick combustion; while other kinds were better employed for steaming on long voyages, from their slow combustion.

The ordinary kind of coal was, generally speaking, divided into two classes; the best quality being employed for household use, while the inferior was used for generating steam. Great economy had resulted of late years in the use of household coal, owing to the extensive use of coke in manufactures; this class of coal being sifted at the pit's mouth, the small, and less valuable part, was used for making coke, while the lumps and larger pieces were employed as household fuel.

It was necessary to say a few words on the manufacture of coke. The best coals for making coke were those which would yield from 60 to 75 per cent. of coke, with but a slight trace of sulphur, and which had the property of caking or melting together, so as to form a solid mass in the oven. This superior quality of coal was found near Newcastle-upon-Tyne, and in Lancashire; the best coke being made from what was called "Mountain Mine." These superior cokes were characterised by their high density, the brilliancy of their appearance, and the superior power of generating steam. He had noticed, from long observation of the manufacture of coke, that the best kind was made when three or four feet in depth of coal were introduced into moderately large ovens, allowed to cake for 60 to 90 hours, and cool for 24 hours previously to being drawn.

He had succeeded of late years in discovering a simple process for removing sulphur from coke, thereby greatly enhancing its value for melting cast iron in the cupola, and increasing the bearing strength of the metal. This was proved by the results obtained by Mr. William Fairbairn, and Messrs. Fox and Henderson. The application of the same process to blast furnaces had enabled Mr. Crace Calvert materially to improve the quality of the iron obtained. Mr. Crace Calvert next drew attention to the third class of coals, namely, those employed principally for making gas. These coals, viz., cannel and boghead, although for commercial reasons Newcastle and other coals of that character are used, were remarkable for yielding in addition to about 30 per cent. of an inferior coke, a large quantity of gas, and numerous other products of greater or less value. The accompanying table would give an idea of the numerous products which chemists had ascertained to exist in the substances distilled from coal:—

Gases.	Liquids.	Solids.
Bicarburetted hydrogen	Bisulphuret of carbon	Napthaline
Propyline	Ammonia	Para napthaline
Light carburetted hydrogen	Eupion	Paraffine
Hydrogen	Paraffine oil	Pyrene
Oxide of carbon	Aniline	Chrysene
Sulphuretted hydrogen	Leukol	
	Carbolic acid	
	Benzine	
	Napthine	
	Napthole	

It will be perceived from this table that the products obtained from coals were divisible into three classes, namely, gases, liquids, and solids. He did not intend to dwell upon the first class—the gases—which subject was so extensive that it would require to be treated in a separate paper. With respect to the solid products of coal, he would first allude to the coke which was obtained in making gas.

The coke generally obtained from gas works was very inferior. Great efforts had lately been made to obtain the various products of coal, and also to manufacture good coke for cupola and railway purposes, at the works of the London Gas Company, but he was not aware of the exact results obtained.

The liquid products from coal could be divided into two distinct classes, the aqueous portion and the tarry portion. The aqueous portion was valuable chiefly for the ammonia which it contained, and which was put to the following amongst other uses: In the first place, it was bought by chemical manufacturers, who obtained from it sulphate of ammonia for agricultural purposes, sal ammonia for soldering, and which was also used in calico and print works in the production of a style of prints called "steam goods." From these two salts was obtained hartshorn, which was extensively employed in pharmacy.

Ordinary coal gas liquor was often employed to obtain by distillation common ammonia, which was much used in dye works; also to produce, with lichens, beautiful colouring matters called orchill and cudbear, valuable for the production on silk and wool of delicate purple hues. The production of this colour and the influence of ammonia was exceedingly interesting, on the ground that the colouring principle called orcine was colourless until acted upon by the oxygen of the air and ammonia. If to this ammonia a fixed alkali be added, then no more orchill or cudbear was produced, but litmus, which was now much used in chemistry as a test for acids and alkalis.

One of the most interesting and useful of the applications of ammoniacal liquors was in the preparation of ammoniacal alum. The manufacture of this substance had become very extensive of late years. At the chemical works of Messrs. Spence and Dixon, near Manchester, 800,000 gals. of ammoniacal liquor were annually consumed in the manufacture of ammoniacal alum, the ammoniacal liquor being obtained from the extensive gas works belonging to the

corporation of Manchester. The manufacture of this substance, which was so valuable as an astringent, and also to the dyer and calico printer, furnished such a remarkable illustration of the value of chemistry in aiding manufactures and commerce, that he would explain briefly the method of producing it. To obtain this substance called ammoniacal alum, a refuse product of coal pits, known as aluminous shale, was heaped into small mounds and slowly burned. Shale was generally found in hard masses, which fell from the roofs of the coal mines, and the object of burning it was to render it porous and friable. The calcined friable mass was then placed in large leaden vessels, with sulphuric acid, having a specific gravity of 1·65, being the strength in which it was obtained from the leaden chambers. It was a curious fact that this sulphuric acid could be produced from another refuse found in coal mines, namely, pyrites.

The calcined shale and sulphuric acid were heated in these leaden chambers for about forty-eight hours, the liquor was then drawn off and put into another vessel, into which the ammonia generated from another refuse of coal, namely, the gas liquor, was introduced in a gaseous state. Thus these three substances, the alumina from the shale, the sulphuric acid obtained from the pyrites, and the ammonia from the gas liquor, combined to produce ammoniacal alum, which then only required purifying by successive processes of crystalization to give it that remarkable purity in which it was furnished to the commercial world by Messrs. Spence and Dixon, and other manufacturers.

A great boon would be conferred upon agriculturists if the ammonia which was produced when coke was made in common ovens, were saved, as recommended by Dr. Lyon Playfair, who estimated that every hundred tons of coal would yield, on the average, about six tons of sulphate of ammonia. The quantity of coke made annually in England amounted to at least 1,000,000 tons, yielding, therefore 60,000 tons of sulphate of ammonia, which might be made a cheap and valuable agent in agriculture. When the minimum advantages which manufacturers had derived from saving the ammoniacal products in gas works were remembered, it ought to encourage coke manufacturers and engineers to exert themselves to effect the same. In so doing they would confer a great benefit on the public, as coke would thus be enabled to be sold at a lower price. It was interesting to reflect that, no doubt, at the present day, tons of salts of ammonia were made, where formerly pounds were imported into England, from a district called Ammonia, in Nubia, in Egypt, and which, in the form of sal-ammonia, was derived from heating in glass vessels the soot which had been produced by the burning of camels' dung. The same line of thought might also be applied to alum, which formerly came entirely from the East, then from the environs of Rome, and now, through the application of chemistry to manufactures, the progress of human intelligence, the undaunted perseverance of our countrymen, was manufactured in England from what had been hitherto noxious and refuse products.

Mr. Crace Calvert next spoke of tar. This substance was generally sold to the tar distillers, who obtained from it a volatile fluid called coal naphtha, a light oil, composed principally of carbolic acid and a heavy oil of tar, a solid substance called pitch being also left in the retort. Mr. Crace Calvert then proceeded to state the applications which these various materials received. Pitch had of late years been used successfully by the corporation of Manchester in assisting to pave the streets. When the streets were repaved, a large quantity of this pitch, to which was added tar and asphalte, was heated in portable boilers in the street, and was poured, when in a hot liquid state, upon small pebbles or gravel between the interstices of the paving stones, which were thus firmly bound together and became so durable that the most frequented thoroughfares in Manchester, when thus paved, had not required repaving for several years. There was, however, this important sanitary advantage connected with the plan, and to which he wished to draw special attention, namely, that no impure matter and stagnant water could percolate through the impervious pavement and collect beneath, giving forth noxious effluvia to the injury of the health of the inhabitants of large cities, and even causing dangerous epidemics. The importance of this process would be the more apparent when it was calculated what a vast surface area was presented by the streets of a large city.

This pitch had also of late been submitted by Mr. Bethell to a further distillation in retorts, which enabled him to obtain a porous, but at the same time a dense coke, and the oils which were distilled in this operation appeared to be such as might be employed to advantage as lubricating agents for common and heavy machinery. Before passing to the various volatile products obtained from the distillation of tar, Mr. Crace Calvert stated, that tar had been applied lately, when mixed with gutta-percha or India rubber, to insulate telegraph wires, and to prevent metals from being acted upon by the atmosphere.

One of the first products which came over in the distillation of tar, was a mixture of very volatile hydro-carbons, which had received the name of crude naphtha, and this, when again distilled, was sold under the name of naphtha, and was chiefly burned by the keepers of stalls in streets and markets. When naphtha had been mixed with turpentine, it was called camphine, and was burned in lamps in private dwellings.

When it was intended to apply this naphtha to more particular purposes, it was purified by mixing it with ten per cent. of its bulk of concentrated sulphuric acid, and when the mixture was cold, about five per cent. of peroxide of manganese was added, and the upper portion was submitted to distillation. The rectified naphtha found in the receiver had a specific gravity of 0·85. This rectified naphtha was used to dissolve caoutchouc for making garments impermeable to water, known as Mackintoshes; and when sulphur was added, and the mixture submitted to steam having a temperature of from 400 to 500 degrees, vulcanized india-rubber was produced.

Rectified naphtha was also used for mixing with wood naphtha, to render the latter more capable of dissolving resins for the production of cheap varnishes. When this rectified naphtha had been submitted to a series of further purifications, it had received from an eminent French chemist named Pelouze, the name of "benzine," which had the property of removing with great facility spots of grease, wax, tar, and resin, from fabrics and wearing apparel, without injuring the fabric, its colour, or leaving any permanent smell or mark, as was the case with turpentine. Benzine had, through his (Mr. Calvert's) exertions, been introduced into England, and had been found most valuable in brightening velvets, satins, &c. The numerous uses to which this valuable product could be applied in manufactures, must in time render it of extensive employment in place of alcohol and other fluids, which were generally speaking too expensive for common commercial purposes. As an instance, he cited that at the present day in Yorkshire there was a large quantity of wool dyed before it was spun, principally for carpet manufactures. It was then necessary to oil this dyed slubbing wool, as it is called, and up to the present time no means had been discovered of removing the oil without injuring the colour, and thus this oil remaining in the fabric materially injured the brilliancy of the colour, as well as rendered the carpets thus manufactured liable to become sooner faded or dirty. Now by the employment of benzine, which had not the property of dissolving colours, the oil could be removed from such fabrics, and the full brilliancy of the colours fixed on this slubbing wool be restored. He also stated that this benzine could be employed with advantage in photography, in removing the grease from daguerreotype plates. When this benzine was treated with strong nitric acid, it gave rise to a sub-

stance called nitro-benzine, which was every day becoming more and more employed as a substitute for essence of bitter almonds, was used for flavouring dishes, and communicating scents to perfumery, soaps, &c. It was interesting to observe that thus, by the triumphs of chemistry, a delicious perfume had been produced from the noxious smelling refuse of coal.

The next products he should mention which were distilled from coal, were those which had the name of light oils of tar, which remain on the surface of water, and which had been applied, conjointly with the heavy oils, with great success by Mr. John Bethell, to the preservation of wood from rotting. Wood which had been treated by Mr. Bethell's process, was extensively employed as railway sleepers, and wherever wood work was exposed to the influence of moisture and the atmosphere. The introduction of the fluid into the wood was effected by placing the wood in close iron tanks, exhausting the air, and then forcing the oil into the whole substance of the wood, under a pressure of from 100 to 150 lbs. to the square inch.

There existed in these light oils of tar a product highly interesting, called tar creosote, or carbolic acid, which possessed extraordinary antiseptic properties; such, for example, as preventing the putrefaction of animal substances. He (Mr. Crace Calvert) had applied it with success in preserving bodies for dissection, and also in preserving the skins of animals when intended to be stuffed. Owing to its peculiar chemical composition, he had also employed it successfully of late in the preparation of a valuable dye-stuff, called carboazotic acid, which gave magnificent straw-coloured yellows on silk and woollen fabrics. The carboazotic acid prepared from the above-mentioned substance could be obtained very pure, and at a cheap rate, thus enabling the dyer to obtain beautiful yellows and greens, which were not liable to fade by exposure to the air, as was the case with most of the yellows and greens which were obtained from vegetable dyes. The advantage of the carboazotic acid, so prepared, was, that it was entirely free from oily or tarry substances, which had the property of imparting a disagreeable odour to the dyed fabric. The intense bitter which this acid possesses had induced him to have it tried as a febrifuge, and Dr. Bell, of Manchester, had succeeded in curing several cases of intermittent fever by its aid, in the Manchester Infirmary. He had also placed some of this substance in the hands of eminent physicians throughout the country, and he hoped shortly to ascertain that it was of real value as a substitute for that expensive medicine, sulphate of quinine.

He had lately applied carbolic acid in a manner that offered advantages to dyers and calico printers. It was well known that extracts made from tanning matters could not be kept for any length of time without undergoing deterioration, in consequence of the tanning matter which they contained becoming decomposed, and transformed, by a process of fermentation, into sugar and gallic acid; which acid, he had ascertained, not only had no dyeing properties, but that, on the contrary, it was injurious, from having a tendency to remove the mordants which were employed to fix the colours on the cloth. It was also known that gallic acid possessed no tanning properties. By adding a small quantity of carbolic acid to the extracts of tanning matter, they could in future be kept and employed by the dyer as a substitute for the substance from which they were obtained—by which would be gained the double advantage of saving labour, and obtaining a better effect from the tanning matters.

The third substance which passed off in the distillation of tar was called heavy oil of tar, which was used by Mr. Bethell as above stated. This substance contained a ingular organic product, first discovered by Dr. Hofmann, of London, and called by him "kyanol" or "aniline," which possessed the property of giving, with bleaching powder and other agents, a magnificent blue colour. This fact led him (Mr. Calvert) to observe that this last mentioned substance, as well as carboazotic and indigotic acids, being produced as well from indigo as from coal-tar, proved the great similarity and chemical connection which existed between the products of tar and those of indigo, and induced him to believe it extremely probable that those products would be employed within a few years as substitutes for indigo and madder. Laurent had succeeded in obtaining two products from naphthaline which had a great analogy to the colouring principles of madder. A substance, for instance, called chloronaphthalic acid had the same composition as the colouring matter of madder, and would be identical if the hydrogen gas was substituted for the chlorine which the acid contained. Hence the chloronaphthalic acid had the property of giving with alkalies a most superior red colour.

When the colouring principle of madder was treated with nitric acid, a substance called alizaric acid was obtained, which was identical with a substance also obtained from naphthaline, called naphthalic acid. Naphthaline was a solid white substance, which distilled in large quantities during the distillation of tar.

An interesting fact had been discovered by Mr. James Young, of Glasgow, namely, that if coals were distilled at a low temperature, the products obtained were different from those which were produced when coals were distilled at a high temperature, as was the usual custom in the manufacture of gas. Without entering into all the details on this point, he would mention one of the most striking differences of results, namely, that Mr. Young obtained in place of the naphthaline, a valuable lubricating agent, called paraffine, a solid substance, and a large quantity of carburetted hydrogens were also distilled, which, being free from smell, were valuable for commercial purposes, and had received the general name of paraffine oil; or, as Dr. Lyon Playfair remarked in his report of the Great Exhibition of 1851, it was "liquified coal gas." This paraffine oil, when mixed with other oils, was now most extensively employed in the cotton-mills of Manchester and the neighbourhood. Solid paraffine was also obtained in the distillation of peat, and was employed for manufacturing candles, there being added to it about 20 per cent. of wax. These candles were remarkable for their transparency and the pureness of their flame. Mr. Crace Calvert exhibited specimens of these candles, and of the various substances mentioned in his lecture, and by which he had illustrated his remarks throughout, and exemplified the truth of his facts and statements. He stated that he was indebted to Mr. Edward Binney, of Manchester, for the collection of coals which were on the table, and to Mr. Clift for most of the valuable specimens of products obtained from coal-tar.

DISCUSSION.

The Chairman said it now became his duty to invite discussion on the very interesting paper just read, and he was sure all must be pleased with the animation and vigour with which the subject had been brought before them. Mr. Crace Calvert was a bright example of the importance of that happy alliance between England and France which they were all anxious to encourage. Mr. Calvert studied chemistry under the first French chemists, Chevreul and Dumas, and so long did he remain abroad, and so assiduously did he devote himself to his studies, that when he returned to England he had lost his native tongue. He was glad however now to find that he had regained the proper use of his own language, and that he still retained all the animation of our neighbours. The subject which Mr. Crace Calvert had brought before them was not only of great practical importance, but of great philosophical interest. When lecturing in this room on the Results of the Exhibition of 1851, he (Dr. Playfair) declared that the great end in modern civilization was to effect an economy of time, or to make the most refuse

products conducive to the advantage of manufactures and arts. When coal gas was first introduced into use, it was contended that there was an intolerable quantity of refuse for which no use could be found, but now there was not one particle of that refuse with the exception of the naphthaline which was not already of great commercial importance. So important indeed had the waste products become, that many of their manufactures could not get on without the oils and dyes produced from them. Mr. Crace Calvert in alluding to the various products from coal, with the exception of the gases, had divided them into aqueous and tarry, and if he (Dr. Playfair) alluded to them, it was only to call their attention to some points which Mr. Crace Calvert had not noticed. That gentlemen had showed them how alum was obtained, and had spoken of it with a fondness as though it were a child of his own, and he had pointed out its importance in dyeing; but whilst dilating on the importance of ammonia in its general applications, he did not tell them that it was from that fetid mass that ladies' smelling-bottles were filled, and that they derived sal volatile. Then, again, benzine had a most extraordinary effect in cleaning white kid gloves, as he could testify, and that, too, without leaving that roughness which generally attended the operation. Then with regard to carbolic acid, it was expected to prove a most valuable antiseptic, though it had hitherto not been much employed, excepting in the preservation of wood. Mr. Crace Calvert, in speaking of several of these discoveries, had referred to a certain gentleman in Manchester, but he had too much modesty to tell them that that gentleman was Mr. Crace Calvert himself; and with reference to carboazotic acid, should it prove as valuable a febrifuge as he anticipated, it would stamp Mr. Crace Calvert as one of the greatest benefactors of mankind. He had next referred to naphthaline, the odour of which chemists had not yet been able to get rid of—though it would yet be got rid of, and the substance rendered useful in dyeing. He had also shown them how the refuse of coal might be made useful in the manufacture of solid paraffine and paraffine oil. Paraffine obtained from other sources had been long known as a most useful lubricator, and was originally proposed for the works of chronometers. Paraffine had this advantage—it would not combine with the oxygen of the air, and thus become rancid. Paraffine oil from coal possessed all the advantages of solid paraffine, and was now used almost all over the country for lubricating machinery. The reason why the beautiful paraffine candles they had been shown that evening were not brought extensively into use, was, that the manufacturers of the article had a demand for it in its liquid state beyond what they could meet, and therefore it was not to their advantage to manufacture it into candles. He had only thus run through the principal heads in order to point out the subjects for discussion, and should now be happy to hear any gentleman upon it.

Mr. Winsor trusted that he might be allowed to express the deep debt of gratitude which they must all owe to Mr. Crace Calvert for the pleasure, entertainment, and information they had derived from his paper that evening. He had had the honour of being a member of the Society of Arts for upwards of thirty years, and being the son of the introducer of gas lamps into England, if not throughout the whole world, he trusted he might be excused for presuming to address them. He certainly had felt somewhat astonished at what he had heard that night. He recollected when Dr. Playfair was lecturing on the Great Exhibition, in alluding to his father, he spoke of the indomitable perseverance of Mr. Winsor, and he now begged to thank him for that testimony to his father's memory. He now wished to call their attention to the evidence given before Parliament in 1809, when the Chartered Gas Company was applying for its Act of Incorporation. In the preamble of their bill it was set forth that the products of coal were gas, pitch, tar, essential oils, and ammoniacal liquor, and they then produced in the House of Commons specimens of those products of which since so much had been made. He now had great pleasure in moving a vote of thanks to Mr. Calvert for the mass of information which he had laid before them, and for having shewn them how the various products of coal would benefit the whole country,—as gas had for several years. He should be happy at any time to render any information to the Society on the gradual progress of gas manufacture, and he hoped ere long to embody in a work which he would lay before the public, the history of gas-lighting for half a century, leaving it to the scientific world to determine upon its value.

Mr. Varley seconded the motion, and expressed the great satisfaction with which he had heard the observations relative to extending a knowledge of science amongst the people.

The Chairman said, that before putting the question, he would ask if any gentleman wished to make any observation, and he particularly alluded to Mr. Bethell as having had his invention noticed.

Mr. Bethell said, that it was most difficult to touch the various questions brought before them that evening without occupying several hours of their time. Mr. Crace Calvert had brought the subject before them in a very lucid and talented manner, though he had been obliged to notice very cursorily many points for want of time. The possibility of the preservation of wood by tar oil had struck him whilst seeking for some material to preserve wood for railway sleepers. The stone sleepers originally laid down were found to destroy the carriages very quickly—and it being desirable to use some softer material, wood naturally presented itself. How to preserve it then became a question, and it was proposed to use solutions of various chemical salts. It was considered that the decay of wood was principally caused by the albuminous nature of the sap, and that if some matter could be obtained to coagulate it, the decay would be stopped. Corrosive sublimate, and sulphate of copper, were therefore tried for this purpose. It was found, however, in practice, that this process was too expensive, and besides, although it prevented the putrefaction of the sap, it had no effect on the fibrous matter of the wood. He then determined to try the oil of tar, and he was induced to do so from finding that the agents used to preserve the Egyptian mummy were of an asphaltic nature—asphaltic oils being collected in great quantities on the Persian Sea, and in different parts of Egypt, where, in consequence of the heat, it exuded through sandy rocks, &c. Finding that this substance was used for making mummies, he considered that what would preserve animal flesh would preserve wood. He, therefore, determined upon using oil of tar, and then came to be considered the mechanical method of making the wood absorb it. He found that where wood had been used perfectly dry it stood uninjured, if protected from the weather, for ages, as was to be seen in the roof of Westminster Abbey; and he determined so to saturate the wood with oil of tar as to render it impervious to water. The result had far exceeded his expectations. A few days ago some sleepers were taken up between Manchester and Crewe, which had been laid down in 1838, in order that they might be replaced by some of a heavier description, when it was found that the old sleepers were perfectly sound, and they were about to be used on parts of the line where there was less traffic. The unprepared sleepers never lasted more than four or five years. A great many improvements in this country were stopped by the prejudice which people had against anything bearing the smell of gas. For instance, pitch and other products of tar were highly-important in ship-building, yet, so prejudiced were the English shipwrights against coal-tar and pitch, that they would only use the tar and pitch from Archangel or Stockholm, though it cost ten times as much as the English. In the Mediterranean the native vessels which were not coppered suffered very severely from the worm, and the

Maltese and Sicilians found that the Archangel and Stockholm pitch would not protect them, but with the coal pitch and tar no worm would touch the vessels, and there was, therefore, a great demand for the English pitch and tar in the Mediterranean, the boat-builders of which would readily give more for it than for the vegetable pitch or tar; but there was a prejudice against it in England because it was to be obtained cheaply at our very doors. In fact all pitch and tar from the mineral kingdom was much better and stronger than that from the vegetable, and much more of a preservative. By the injection of the carbolic acid from tar, mixed with a little olive oil, into the veins of the body, they might keep anatomical subjects fresh for many weeks, and it would have no effect upon the scalpel, which showed the great power and usefulness of the carbolic acid; and the only reason why it had not been extensively used for the preservation of meat was that the gaseous smell would be more or less retained.

In answer to a question from Mr. Winkworth, Mr. CRACE CALVERT stated that there could be no doubt that when they wished to disturb the streets, paved as Manchester was, for the gas or water pipes, that as the stones had to be raised by the pick-axe there was considerable labour required beyond that for removing the ordinary pavement. The reason why it was not more generally used he could only suppose was that each locality had its own peculiar manner of doing things; but any one who rode over the streets of Manchester could not fail noting how free they were from the jolting and reverberation felt in London and other cities.

The CHAIRMAN, in putting the motion, said he could not help remarking how deeply he sympathised with the remarks of Mr. Crace Calvert relative to the popularising of science; and he might take that opportunity of informing them that so desirous were the Government to aid in that object that they had prevailed on Dr. Hofmann, one of the most eminent chemists of the day, to deliver a course of lectures on chemistry at the School of Mines, for the almost nominal charge of 5s. the course —instead of about £5—and sure he was that it was as little as it could be done for to remunerate the professor at all.

Mr. CRACE CALVERT returned thanks, and expressed the gratification he felt at what he had just heard from Dr Playfair, trusting that the same advantages would shortly be extended to Manchester, Birmingham, and other places. Sure he was, if Dr. Playfair had but a few coadjutors as enthusiastic in extending a knowledge of science as himself, it would soon become as popularised as the most earnest lover of science could desire.

The Secretary announced that at the meeting of Wednesday, the 29th inst., the following paper would be read:—"On various Unused and Unappreciated Articles of Raw Produce from different parts of the World," by Mr. P. L. Simmonds."

REPORT ON THE MUNICH INDUSTRIAL EXHIBITION OF 1854.

CONSUL-GENERAL WARD TO THE EARL OF CLARENDON.—

(Concluded from page 13.)

11. *The Second Group* nominally comprehended a great variety of articles under the denomination of agricultural produce, but which were not all to be found in their places. However, of wool, flax, hemp, and tobacco, there were sufficient specimens. The Silesian as well as the Saxon wools appeared to have lost nothing of their ancient reputation. The Central Agricultural Society in Stuttgardt sent a collection of no less than 216 specimens of clothing and combing wools, of different degrees of fineness, from which the progress of wool-growing in Wurtemberg might be fairly judged of. The number of sheep possessed by that State, on the 1st of January, 1853, was 458,488, comprising the several kinds of sheep—fine-woolled, middling fine, and ordinary woolled. This figure comes near to that of Saxony, whose stock of sheep in the year 1850 amounted to 547,334 head. But according to Dieterici,* the number of sheep possessed by these two states in the year 1842 was—Wurtemberg, 681,159; Saxony, 681,594; which confirms the opinion that the production of the finer wools in Germany is on the decline; partly, perhaps, owing to the increasing importation of the fine wools of Australia into Europe. The entire stock of sheep possessed by the states of the German Customs Union can at present little, if at all, exceed the 22,000,000 head, at which it was rated by Dieterici, in 1842. The number of sheep in the Prussian monarchy was, in the year 1849, 16,296,928.†

The cultivation of flax in Germany is said to be increasing, and the spinning it by machinery is fast expelling the old method of spinning by hand. But the flax spinneries will never be able to compete with those of England and Ireland, until they have a better material to work upon, for the German flax is at present generally deficient both in length and tenacity. Some specimens were, however, exhibited, which deserved commendation; such as the flax sent from Hirchberg, in Prussian Silesia, with the yarns spun from it, Nos. 60 to 120; and an assortment sent from the Austrian establishment at Hannsdorf, in Moravia. A few specimens of Hungarian hemp, sent from Pesth, were much approved.

Of tobacco (the opium of Germany) there were numerous specimens. The culture of the tobacco plant has been very successful in the Palatinate, the Uckermark, and in Franconia; and the increasing consumption has also led to the growth of it in many other districts less favourably circumstanced. The silk cocoons were chiefly from Bavaria, where the breeding of silk-worms is extensively pursued. In this group were also placed a number of fine pearls, from the streams of Upper Franconia and Lower Bavaria, which gratified the national feelings of many good Bavarians; and certainly the Saxon pearls found in the Elster could not compete with them, either in size or beauty.

An agricultural map of Bavaria, on the scale of 1 to 400,000, a botanical map of the country on the same scale, and a table of information relative thereto, constructed by M. Ohnmüller, of Munich, at the desire of the Government, were perhaps the most complete works of the kind ever yet executed. The geognostic state of the country, with all particulars of the soil and its productions, are admirably depicted. At least 1,000 plants, of the size of half-an-inch, are drawn true to nature in the botanical map.

12. *The third group*, comprising a great variety of articles and stuffs used in chemistry and medicine—dyes, gums, resins, oils, &c., does not appear to require particular notice, as the specimens exposed in the Great Exhibition in London sufficiently notified the progress which the German manufacturers were making in this department. The excellent chemical instruction given in the industrial and polytechnic schools has here produced good fruits; and the influence of science has led to many improvements, especially in dyeing and colouring. Some specimens of garancine, from Mannheim, were pointed out to me as worthy of approbation; and the preparations of madder were considered generally excellent of their kind. The jury appointed for this group was so fortunate as to have for its chairman Professor Liebig.

13. The substances composing the *fourth group*, viz., those prepared for food and personal use, are likewise not such as to call for particular mention. The preparation of

* "Statistical Review," &c. Berlin, 1844.

† In the same year the quantity of wool brought to all the summer fairs in Prussia was 191,534 centners; and in 1851 it was 196.199 centners.

flour in the American way has come much into use in Germany; and steam flour-mills are now very common. A large quantity of soap was exhibited; some of it in great masses, and in fanciful forms, such as obelisks and altars. The consumption of this article in Germany is not yet by any means so extensive as it ought to be, but the fault lies rather in the habits of the people than in the manufacture itself. Of beet-root sugar there were samples enough. The production of native sugar is well known to have greatly increased of late years. There were raised within the Zollverein, on an average of the years 1840 and 1841, 241,487 centners; on that of the years 1846 and 1847, 281,692 centners; and on that of the years 1850 and 1851, 736,215 centners of beet-root sugar.* The loss to the revenue consequent upon throwing the colonial sugar out of consumption has been something enormous: but the inland duty on beet-root has recently been considerably raised, and foreign sugar will therefore have a fairer chance of competition than was formerly allowed it.

14. *The Fifth Group* contained a variety of engines, carriages, machinery of all sorts, and agricultural implements. There were three large locomotive steam-engines, manufactured respectively at Munich, Vienna, and Hanover; and two from Esslingen, in Wurtemberg. The fabrication of steam-machinery has greatly extended itself in Germany within the last ten years. Russia alone had in 1849 no less than 1,961 steam-engines for manufactures, railways, and other purposes, with 67,859 horse-power.† Locomotives are constructed not only at the places above mentioned, but at Borsig's, in Berlin (the largest of all these establishments), at Chemnitz, at Cassel, and elsewhere. Formerly England supplied the German railways with their locomotives and tenders, but now an English engine is seldom to be seen. The prices of the two Esslingen engines were stated to be—for the locomotive "Wurtemberg," with tender, 28,500 florins; for the tender locomotive "Sonnenstein" (built for the Austrian line over the Semmering), 40,000 florins, which latter is the 254th engine constructed under the direction of the eminent mechanic Kessler. A number of machines for spinning, weaving, and other purposes, were exhibited by Hartmann, of Chemnitz: Bollinger, of Vienna; Fouquet, of Stuttgardt, and others; but Borsig's establishment furnished no contribution. Some cannon, founded at Munich, occupied a conspicuous place. Among the new inventions were pointed out to me a so-called universal turning-bench, from Saxe Meningen; a new machine for lithographic copying, used in mapping by the Bavarian Surveying department; a burning apparatus, of unusual force, from Carolinen. That in Bohemia, the model of a brick-making machine, constructed to effect a vast saving of labour; a machine for making barley-grits, from Saxe-Gotha; and the model of a military cooking apparatus, from Augsburg, fixed upon a carriage, and capable of providing for 1,200 men. Although I consider the German machinery to be generally inferior in execution to that of England, yet the inventive powers of the Germans are continually at work; and those machine establishments which have the advantage of large capitals have mostly had a successful career. The agricultural implements made a large display, and many of them would, no doubt, excite attention in England. The contributions from Munich, Dresden, and Leipsic, proved the increasing interest that is felt in the promotion of agricultural improvements. The Royal Agricultural Institute at Hohenheim, in Wurtemberg, which is in good repute, both as a practical and educational establishment, published a descriptive list of its models and machines, with the prices annexed. Among the numerous carriages exhibited those of Vienna were considered as occupying the first rank. They combined elegance with solidity, and in this respect were superior to the carriages of Bavaria and Baden, which were often deficient in taste as regards the details of their workmanship.

15. The objects comprised in the *sixth group* were chiefly of a scientific character, and their merits would consequently be less easy of appreciation to the ordinary visitor. Physical, geometrical, optical, and chirurgical instruments, competed with each other from different parts of Germany. A prominent object in the glass-hall was the great refracting telescope, made by Merz (the successor of Frauenhofer), at Munich, valued at 30,000 florins. The optical instruments of Merz, as well as the mathematical and optical instruments of Ertel, in Munich, have a wide and deserved reputation. In music the Germans have made great progress with their pianofortes, which, not merely in cheapness, but in goodness and durability, vie successfully with those of London. From Vienna, Leipsic, Stuttgardt, &c., many excellent pianos were exhibited, and several organs. The horns and wind instruments from Vienna and Bohemia excited the surprise of many by the perfection of their very complicated mechanism. Of clocks and watches there were many good specimens. The cheap wooden clocks of the Black Forest, so generally used by the lower classes of people, are among those articles which have undergone the greatest improvement in their construction in the course of the last ten years.

16. The most important of all the groups, as respects both the nature of its contents and the great number of articles displayed to view (having in it about 2,200 exhibitors), was *the seventh*, being that assigned to textile manufactures, yarns, worked stuffs, and articles of clothing. In the states of the German Customs Union and Austria, there are at least 300,000 weavers employed in factories, and the number of those who are occupied either wholly or partly in weaving at home is probably three times as great. The Prussian Monarchy had, in the year 1849, 2,208 spinning factories, with 25,471 workmen, and 2,837 weaving establishments with 141,412 workmen.* For Austria we have no statistics so recent. In the year 1846 the number of factories in that country for the various branches of textile manufactures is stated to have been 2,207. But the number of looms worked out of the factories must remain in a great degree conjectural.

The yarns exhibited did not, perhaps, form a collection complete enough to warrant a positive conclusion that no progress had been made in Germany in that respect; but no yarns were shown that denoted the power of successful competition with the yarns of Great Britain. The specimens of cotton yarn exhibited were in general under No. 60, and the yarns chiefly produced, both in Austria and the other German States, range between Nos. 20 and 40. In the Nos. 30 to 40 the yarns of Augsburg and Chemnitz were the best; but Prussia was very inadequately represented, for the only Prussian spinning factory which sent specimens was that of Carlsthal, in the Principality of Hohenzollern. Of linen yarn little was known. Of woollen yarn Prussia might have sent the best, but did not. The Austrian was not worth much, though here, as in other instances, Austria and Bavaria were the largest exhibitors.

The fact is that the German cotton manufacture is and must be dependent upon English yarns for many years to come. The protective system has in this instance failed, and the additional duty of a dollar per centner, lately imposed, has only had the effect of injuring the weavers, whilst it has conferred no benefit whatever upon the spinning establishments.

The German linen manufacture is a branch of industry from which many complaints have of late years been heard, and undoubtedly among the hand-spinners and weavers of flax, in Silesia and the mountains of Saxony, great misery and distress prevail. Formerly the Germans used to set the example in their fabrics of linen, but now

* Hubner's "Statistical Year Book."

† From a calculation of Dieterici, quoted by Hubner.

* Hubner's "Statistical Year-Book."

they imitate foreigners, and some of the best linen exhibited at Munich was copied from Irish patterns. From the whole Prussian Monarchy there were not above twenty linen exhibitors. The Westphalian linen was generally thought the most perfect; and Bielefeld sent some excellent pieces. The specimens of hand-work sent by an association at Herford served to show that hand-work, in the middling and finer qualities, could not be made so fine as that produced by machinery, and that the latter was both more durable and cheaper. Saxony, as usual, sent the best damask, but the plain linen stuffs were upon the whole better represented than the damasks; and the opinion of experienced persons was, that Germany could have exhibited better linen than that which actually appeared. Bavaria sent specimens of fustian, which were very inferior.

The woollen manufactures of Germany were in every branch fully represented in the exhibition. From the commonest blankets to the finest cassimirs and woollen velvets, specimens of all were to be seen displayed. The Rhenish provinces sent their cloth, buckskins, cassinets, molton and flannel, satin de laine, croisées, serge de Berry, and half-woollen waistcoat and hosiery stuffs. The best cloths were from Aix-la-Chapelle and Duren. The fine cloths and buckskins of Saxony, and generally the woollen manufactures of the Saxon kingdom and duchies, and the principalities of Reuss, made a most respectable show. But it was the cloths of Austria that undoubtedly made the most sensation, for it was not generally known that the Austrian manufactures had arrived at that degree of perfection of which the numerous specimens sent from Bohemia and Moravia gave evidence. The collections from Brunn and Reichenberg were very remarkable; the specimens were well chosen, and, in the opinion of good judges, the thick cloths of Brunn stood without a rival. The buckskins and half-woollens of Brunn were also generally superior to those of the Zollverein; so that, whenever the duties are abolished, Austria will enter as a formidable competitor in all but superfine cloths, in which the Rhenish and some of the Saxon cloths are still superior, both in colour and stuff. The merinos, Thibets, and mousselines de laine of Austria, are likewise inferior to those of the Zollverein. Of these latter articles the specimens contributed by the different states were neither numerous nor varied, and what were exhibited were in their quality below mediocrity.

The woollen manufacture is undoubtedly one of the most flourishing branches of German industry. It has, less than the cotton manufacture, been impeded by the effect of the protective system, for the duties on foreign woollens do not average more than from twenty to thirty per centner, *ad valorem*, and it has not been exposed to the vicissitudes to which the linen trade has from other causes been subject. Woollen clothing has now, in many articles, taken the place of cotton; for women's dresses, light woollens and worsteds are now generally preferred.

The specimens of cotton stuffs were sufficiently numerous, embracing calicoes, shirtings, jacconets, *piqués*, the so-called white wares, satteens, tops, and coloured and printed stuffs in great variety. There was, however, nothing in them which requires any particular notice. It is well known by what means the Zollverein has succeeded in driving out of her markets all the inferior and middling foreign cottons, and of forcing the population to supply themselves with what is often a much worse article of home fabrication. The protective duties on cotton manufactures range from 50 to 150 per cent. What has been the result? The consumption of cotton within the German Customs Union increased very slowly, and of late years has actually fallen off. In the year 1834, it was 350,884 centners; in 1845, it was 886,252 centners; and in 1850, only 834,985 centners; which figures are respectively in the ratio of 1·5, 3·1, and 2·8 per head of the population.*

* Hubner's "Statistical Year-Book."

The silk manufacture displayed itself in great variety, and occasionally in brilliant specimens. From spun silk to the richest shawls, dresses, and furniture stuffs, every description was to be found. Prussia, indeed, sent but few contributions, of which the best were from the Rhenish provinces. Crefeld exhibited its velvets, plain silks, ribbons, and rich church stuffs. The old established house of Diergards, at Viersen, was, as usual, distinguished for its velvets, ribbons, waistcoat stuffs, and plush. From Barmen, Uerdingen, Ronsdorff, &c., there were many good specimens. I heard, however, that the silks exhibited attracted no one in the way of purchasers. The prices were, as a general rule, refused to be stated, and even some of the Liepsic dealers, who applied for prices with a view to business, had difficulty in obtaining them from the manufacturers. Austria made a large display, and her velvets, plush, and embroidered stuffs were generally good, but in plain silks and ribbons, she stood below the Zollverein. The Austrian silks are dearer than those of the Zollverein, which exports to the value of 10,000,000 or 12,000,000 dollars yearly, and in part to America, in competition with France and Switzerland; whilst Austria exports only to her own non-German dominions. It is true that ribbons are imported from Switzerland into Germany, because labour is cheaper in Switzerland; but silk-weaving is certainly one of the most important branches of German industry, and Prussia alone had, in the year 1849, no less than 24,042 silk-looms at work. The manufacturer does not require protection, and, in fact, the present custom duty of 110 dollars per centner does not average more that six or seven per cent. *ad valorem*.

The excellent velvet made in the Rhenish provinces forces its way into France by means of the smuggler. The light velvets at low prices are the best; few heavy velvets were exhibited. The cheapness makes up for the difference between the German and the French velvet; the Rhenish weaver can work cheaper than the weaver of Lyons. In taffeta, lustrine, satin, and furniture stuffs, the productions of Berlin and of Saxony were strong. Wurtemberg, as well as Bavaria, have, in some kinds of silks, manufactured too much and exhibited too much. Austria was very superior in the rich brocades of silk, and mixed silk and cotton, which are used in church services and for priests' vestments; but her velvets were considered behind those of Crefeld and Viersen. The Austrian plain silk stuffs want firmness. The Italian silk is rather too woolly. But the Austrian ribbons would probably find a large vent in the Zollverein states if the duties were removed; though the patterns want originality, and are often, like many other things in Germany, imitated from the French.

Although the German states are exporters of silk manufactures, yet it would seem, from some recent calculations, that the consumption of silk at home has rather declined. The quantity of silk consumed within the German Customs Union was, in the year 1834, 3,890 centners; in 1845, 9,135 centners; and in 1850, 7,056; being in the ratio respectively of 0·015, 0·032, and 0·0237 per head of the population.* For Austria we have not the same statistics; but we know that the production of silk in the Italian provinces has greatly increased, and now exceeds 5,000,000 pounds annually. There were, however, but few specimens of Italian silk exhibited; from the Tyrol and Vorarlberg there was a better supply.

The embroidered silk and cashmir shawls of Vienna were well represented. The Austrian coloured and variegated cloths for tables, &c., and the felt manufactured at Prague for articles of clothing, also excited attention. A new invention appeared called *Glanz Percal*, being silk or other stuffs, printed with gold or silver, so as to resemble brocade, by Schreibmayer, of Munich. The hosiery from Chemnitz, Apolda, &c.,

* Hubner's "Statistical Year-Book."

offered no novelty; its cheapness is its only recommendation, for in durability it cannot compete with the hosiery of Derby or Nottingham. Of leather and gutta-percha there were a great many specimens, worth little notice. There was some fine Morocco leather, made at Vienna; but the saddlery, trunks, and other articles of manufactured leather, were of a very inferior description. Of the lace exhibited, that woven by hand, from Bohemia and Chemnitz, was the most admired. The display of articles of clothing and shoemakers' wares occupied a considerable space.

This group was quite unnecessarily large, and a great number of ordinary and trifling articles might very well have been excluded from it. If a selection of the best and most interesting specimens had been made, the group might have been reduced to one-third or one-fourth of its actual dimensions, and the object attained with a saving of expense—and convenience to the public. But taking the department as it stood, with the productions of 2,200 exhibitors, there was really little in it to show any advance in the branches of industry which it represented, much less to excite any well-grounded fears on the part of the British manufacturer lest his exertions should be outstripped by German competition.

17. In *the eighth group* were placed the manufactures of iron, steel, and other metals, jewellery, gold, and silver wares, and arms. It comprised, of course, a great variety of objects—from the coarsest iron pots to the finest gold leaf, from the cheapest tin wares of the Saxon ore mountains to the most costly jewels from Vienna or Munich. A silver table service, made for the Crown Prince of Saxony, from the designs of Professor Reitschel, possessed much artistic merit. A large collection of tools sent from Werthiem's great establishment, at Vienna, was purchased by the Bavarian Government for the School of Trade at Fürth. Among the good specimens of cast iron, there was an open fire-place, gilt, and stoves from Dusseldorf; an English stove, and figures from the Einsiedel Iron Works at Lauchhammer; and some bookcases and mirror-frames from Luxemburg. The guns of Suhl, Solingen, Prague, and other places, are in good repute, and their prices lower, from being less highly finished than those of London. The German cutlery, though still inferior to the English, has really improved; and the locks are likewise something better than they were; but in fine steel work, needles, and pins, Germany is much in the back-ground. Upon the whole, the articles in this group made a respectable figure, though their number might also have been much reduced. The cast-iron manufactures were those which excited the most attention.

18. The marbles, earthenware, porcelain, and glass *in the ninth group* formed some of the most striking objects in the Exhibition, and in many of them a great deal of artistic beauty was observable. Works of coloured marble were to be seen, distinguished by their architectural forms and neatness of execution. The Silesian marble quarries, now so generally known, were first opened by a Frenchman, M. Laverdure of Breslau, from whose manufactory several good specimens of workmanship were sent. His marble vase, with a glass grey ground, and green veined, distinguished itself for its noble form and accurate execution. Its height, including the pedestal, was about ten feet. His table plates of marble and granite were very large and fine, as well as his marble blocks of fragments from the Silesian quarries. There were also some fine marble plates from the Salzburg; a granite table from Lusatia, and green porphyry; a handsome table in stone veneer work from Berchtesgaden; a slate table from Franconia, with numerous marble plates, consols, &c., with and without mosaic; also a malachite table, and mosaic table plates, by Ganser the sculptor, of Munich, one of which, with figures of Ulysses and Penelope, was considered a masterpiece of classical art. There was a new invention of artificial stones for pavements; also specimens of Munich sand-plaster worked into polished marble and mosaic; a new and remarkable invention of chemically printed lithographic stones, with colours let in, from Sohlenhofen in Upper Bavaria; good imitations of old Egyptian vases; an altar and a table of gypsum marble by Viotti of Munich; some good figures and vases in burnt pottery by Professor Folz; also excellent specimens of building ornaments and other figures in burnt pottery from Charlottenburg and from Vienna; and some tasteful marble floorings from Nassau.

Of porcelain there were, as might be expected, many beautiful specimens sent from the Royal Manufactories of Munich, Berlin, Dresden, and Vienna. The Royal Factory at Nymphenburg, near Munich, is under the direction of an eminent artist, M. Neureuther, who has done much to improve the style of porcelain painting. He belongs to the German romantic school, and his conceptions are in that spirit, and worship national traditions and national poetry. A porcelain hunting-service, designed by Neureuther, was shown, which gave some idea of the new direction of the forms which the Bavarian porcelain is now taking. The Berlin manufacture is also getting out of the old Rococco fashion of the last century, and shows a taste for the models of classical antiquity, and the pure style of Winckelmann, Carstens, and Thorwaldsen. There were several large vases, from two to seven feet high, of Berlin porcelain, with views of the Royal Palaces, which proved very attractive. The Berlin imitations of the old Tuscan china have been also successful, and are not dear. The Dresden porcelain is now considered rather old-fashioned; it adheres too exclusively to the Rococco style. The same is the case at Vienna; and, indeed, the Vienna porcelain is very much in arrear in point of taste, and shows less signs of improvement than any of the other manufactories. However, there was a very handsome chimney-piece from Vienna, with paintings on porcelain, which was a good deal admired. From the porcelain factory at Zell, in Baden, some good specimens were also sent. The Berlin earthenware stoves continue the best in Germany; those of Hamburgh are considered to stand next to them.

The Bohemian glass, and its rival the Bavarian, both now so well known, imparted a lustre to this, as they have done to other Exhibitions. The glass fabrics of Hofman, at Prague, and Count Harrach, at Neuwell, in Bohemia, take the first rank in this department; but the Bavarian factory at Steigerwald, occasionally surpasses them in elegance of form. A glass, with flowers let into it by a new method, the invention of Reinsch, of Munich, was classed in the seventh group. Some painted sheet-glass, by Irmer, of Coburg, combined beauty with cheapness, which may also be said of the glass transparencies made by Schaller, of Nürnberg.

19. The manufactories of wood and hardwares, which formed *the tenth group*, comprised some tasteful, as well as curious articles. German furniture is not generally remarkable for beauty of form; nevertheless, from Vienna, as well as from Munich and from Bamberg, there was furniture at once substantial and not inelegant. The Munich Trades Union (Gewerbe-Verein) contributed a variety of articles, under the head for which a separate locality was assigned: mosaic tables; wooden parquet floorings, by Kuhler, of Munich, newly invented and cheap; handsome altars, by Maier and Strathaus; curiously cut ivory; a prize beer table and cups from Wursburg; improved beds; and a richly carved stand and case for King Louis's album, by Possenbacher of Munich; the cork model of a Roman amphitheatre; and tables of rosewood inlaid with flowers, painted in burnt porcelain, by Theyer, in Vienna, were among the prominent objects. Of Nürnberg wares there was an abundance, with many curious productions from other parts of the country cut in wood, such as a chessboard, purchased by the King of Prussia. The best carved Meerschaums were from Vienna; and there was a beautiful carved ivory cup, by Hagen, in Munich. Looking at those articles which are not exactly artistic, but are yet distinguished for tasteful forms, we shall

find in the tin and pewter work, as well as in the joinery of Munich, much deserving of commendation. To the former belong the drinking-cups of Kreitmann and Peucker; to the latter, the wood mosaics of Förtner, which are superior to those of the middle ages as well in execution as in design.

20. *The eleventh group* displayed a great variety of paper, writing, drawing, and printing materials, with specimens of books and bookbinding. The literary activity of Germany makes the materials of literature an important consideration; but in these materials cheapness rather than excellence is the object aimed at. The writing paper generally is of a very thin texture, and in so far an inferior article to that in use in England; the paper on which books are printed is also below that of England, both in quality and whiteness. A well-bound book is seldom seen. However, in the article of pencils, those manufactured in Nürnburg and elsewhere in Germany compete successfully with the English; and the art of printing is greatly improved. The method of printing off oil pictures by the printing-press, as practised at Munich, and at Haase's large establishment in Prague, is found very successful, and cheap pictures are thus diffused, to the great improvement of the popular taste. The collection of lithographs called "King Louis' Album," was here exhibited; also some marble-paper, of which the colours were excellent, from Vienna; and some pieces of gold and of silver-paper made in Munich, which reached the extraordinary length of thirty feet. Specimens of old prints, cleaned after a new method by Heigl, of Munich, and a collection of animals stuffed in Munich, were also placed in this group; to which, however, the most remarkable contribution was a collection of the manifold and interesting productions of the Austrian State printing-office in Vienna, consisting of plates, stamps, and specimens of photography, galvanoplastics, chalcography, stylography, steel engraving, wood-engraving, stenography, &c. In this collection were plates and impressions produced by the new invention called the "Natural Printing Process," by the director of the State printing-office, M. Louis Auer, which creates by means of the original itself, in a simple and expeditious manner, plates for printing copies of materials, plants, lace, embroidery, &c. These plates are capable of effecting two results upon paper; the one a coloured copy of the original upon a white ground —the other a white copy upon a coloured ground; and in both instances without the aid of drawing or engraving. The proceeding is very simple, viz., by placing the object between a plate of copper and one of lead, and driving it forcibly between two firmly fixed rollers, when the original object leaves a perfect impression of itself (however fine or delicate its structure or mechanism), upon the plate of lead; and this is done without almost any cost, and with the utmost rapidity of execution. The Natural Printing Process is, without doubt, an important discovery, and will probably play a great and useful part in the future career of typographic industry.

21. The department of the fine arts, (*twelfth group*), comprising the contributions of about 150 exhibitors, contained statuary, casts, and bronzes of great merit. The strict rule of Industrial Exhibitions properly excludes pure works of art, and the first artists would rather shrink from being represented in them. Plastic productions, however, principally those of cast iron, and having a monumental character, easily find their way into such Exhibitions, and belong to them more properly than pictures, even those on porcelain or glass. The Munich Glass-hall displayed a variety of artistic works, and not only those which, though strictly speaking manufactures, verged upon the province of art, but such as had no subordinate object, and whose merit lay in their beauty alone. Among these artistic works may be favourably mentioned—

The three fountains belonging to the building, by the architect, De Voit.

Colossal statues of the Americans, Henry and Jefferson, cast in iron ore at the Royal Foundry in Munich; also a Madonna and other figures of cast iron ore, some chiselled, and others not; bronze casts and medallions; and a beautiful case for "King Louis' Album;" all from the Royal Foundry.

Plaster models by Brugger, of Munich; among which a fawn playing with a panthress was considered excellent.

Arms and other utensils made to resemble those of olden times, by Fortner, of Munich.

A Madonna, in relief, of Tyrolian marble, by Hauptmann, of Munich. The Loreley, in plaster, by Herold, of Munich.

Cups, arabesques, boxes, figures, &c., of carved ivory, by Hagen, of Munich.

Figures in plaster of Amor and Psyche, Bacchus and Ariadne, by Hönig, of Munich.

Models of fountains; the Four Seasons, in terra cotta; a candelabrum of granite, &c. by Leeb, of Munich.

Figures of the poets, by Schaller, of Munich, with a bas-relief after Shakspeare, in ivory, and busts.

A magnificent painted-glass window, from the Royal manufactory at Munich, destined for a church at Hamburgh. The celebrity of the Munich painted glass is now so great that it requires no particular description here. Some of the best specimens are the new windows in Cologne Cathedral, which were presented by King Louis. The Munich painted glass is, however, expensive. That made by Kellner, of Nürnberg, of which specimens were exhibited, is good of its kind, and comparatively cheaper. There were also contributions of painted glass by Hildebrand, and other manufacturers, which had great merit.

Xavier Schwanthaler's marble gable group, for the Athenian Propylœa, representing the Enthronement of King Otho; also other figures, the Salvator Mundi, Venus and Amor, &c., in plaster, and several statuettes by the same master.

The medallions of Voigt, of Munich, viz., Psyche and Amor, a Medusa's Head, and one of Thorwaldsen, with copies of medals, and some works in onyx.

A hunting group, by Professor Widnmann, cast in zinc, and Hercules' shield in galvanoplastic copper, by the same eminent sculptor.

Specimens of Dyck's newly-revived old leather-plastic for binding books, an apparently valuable invention.

A porcelain mosaic of the Madonna dal Sisto, by Neureuther.

A noble group of St. George and the Dragon, cast in zinc; figures, flower-stands, and a summer-house, of cast iron; from Prince Salm's foundry in Vienna.

A fountain and other objects in cast iron, by Professor Kalide, of Berlin.

A pastoral group, in zinc, cast, chiselled, and bronzed, by Julius of Berlin.

A table-service, goblets, &c., by Burgschmiet, of Nürnberg, a sculptor who has successfully executed several colossal statues in cast iron and bronze.

The Twelve Apostles, in cement, by Bichl, of Munich.

The above are cited as a few instances of artistic productions which struck me favourably, and which were commended by more competent judges. An examination of these, and of the many other works of the same class displayed in the Exhibition, would be more than sufficient to show that art is not stationary in Germany, and that those branches of it which are partly dependent upon manufactures (such as the modelling in cast iron and zinc) are steadily and rapidly improving.

Plastic modelling offers a wide field of exertion to the numerous class of sculptors who, though possessing talents, find it impossible to obtain employment in the higher and more costly branch of sculpture in marble or stone. There are in Germany, as in other countries, a number of wealthy people who have a taste for art, and would willingly decorate their houses and gardens with good plastic figures, but are reluctant to go to the expense of marble statues or reliefs. It seems, however, that a

suitable material for plastic art remains yet to be found. Gypsum is too chalky, and looks poor; burnt clay is too fragile; sandstone is both too heavy and too dear for the purpose; the galvanoplastic imitations of cast iron, if of any size, are unattainable on account of their price; zinc is, indeed, cheaper; but still the substance has not been discovered which is well suited for casts, and combines fineness with cheapness in the requisite degree to enable copies of the best ancient and modern pieces of sculpture to be made to any considerable extent. In such copies, the Munich Exhibition is entirely deficient, and however credible are the casts in iron and zinc which appeared in it, it is evident that the plastic art wants the means of diffusion which the existence of a better material for casting would at once afford it. Possibly the close communication and connection which exists between artists and manufacturers in Germany, and which the Munich Exhibition was well calculated to promote, may bring about this, among other improvements, before very long.

22. *The prizes* were not publicly awarded when I was in Munich. I learned, however, that they were to be divided into three classes, viz., 1st. a large medal; 2ndly. an honorary medal; 3rdly, a laudatory mention. Of the large medals there would be 267 distributed, of which the seventh group (textile manufactures) would take no less than 97, and the next greatest number of them was to be awarded to the fourth and fifth groups (articles of food and machinery), which were to have 29 each. Of the smaller or honorary medals, 960 were to be distributed, and the laudatory mentions were expected to be very numerous. There was a natural desire on the part of the exhibitors to obtain prizes; but I have heard it doubted whether public opinion attaches much weight to such distinctions. The jury commissioners are supposed to be rather too solicitous of giving general satisfaction, and the number of prizes does certainly seem much greater than the circumstances could properly require.

23. I have thus endeavoured to state succinctly to your lordship the principal points which struck me in visiting the Industrial Exhibition at Munich. Its chief faults were, that it was so much overloaded with trivial and unimportant articles, and that it did not fairly represent the manufacturing industry of the whole of Germany. In the department of the textile manufactures, it did not rise above mediocrity; but in respect of machinery, as well as artistic objects, much improvement was visible. If the Great Exhibition in London has given Germany the spur in some branches of her industry, the approaching French Exhibition will naturally have a similar effect; and, considered in the light of a trial of strength for Paris, the Munich Exposition will not be without its utility. If compared with the Berlin Exhibition of 1844, it rises certainly in apparent magnitude. At Berlin there were about 3,000 exhibitors, and the goods exposed were valued at 1,000,000 dollars, or 150,000*l.* sterling; at Munich there were 7,000 exhibitors, and the total value of the goods was stated to be 14,000,000 florins, or 1,448,276*l.* sterling.

As a financial speculation, the Munich Exhibition has proved signally unfortunate. Even during the first month, when Munich was filled with strangers, the number of visitors did not often exceed 3,000 daily, and was some days much under that mark. The ordinary price of admission was only 12 kreuzers (4½d.), except on Mondays and Fridays, when it was 30 kreuzers (1s.) This did not promise a large revenue; but in the second week in August the cholera unhappily broke out in Munich, and strangers in general were intimidated from approaching it. For several weeks the place was actually deserted by a large portion of its inhabitants in order to avoid the disease. The consequence was that the number of visitors to the Exhibition greatly diminished, and there were many days when the persons who paid for admission were not equal in number to that of the servants of the establishment. Now, as it was necessary to maintain a staff of from 500 to 600 employés for a period of three months, it will be easily understood that the charges of management, added to the cost of the buildings, amount to a very large sum of money, against which the receipts form but a trifling item. The loss to the Bavarian Government will, it is supposed, amount to at least 2,000,000 of florins. The long and severe visitation of cholera could not of course be anticipated; but even if this calamity had not occured, the frequency of the visitors would probably not have been nearly sufficient to defray the expenses of the undertaking.

24. The question how far it may be desirable to obtain admission for British goods at any future German Exhibitions is not likely to occur, since by the regulations of the German Customs Union, these Exhibitions are strictly confined to the produce and manufactures of the German States only.

25. I ought in conclusion to acknowledge the courtesy with which I was received by the Bavarian Minister for Foreign Affairs, the Baron von der Pfordten, as well as the attentions paid to me by the President of the Managing Commission, Dr. de Fischer, Councillor of State.

I have, &c.,

(Signed) J. WARD.

THE SMOKE QUESTION.

At the meeting of the Institution of Civil Engineers on Tuesday week, the paper read was "On the means of avoiding Smoke from Boiler Furnaces," by Mr. W. Woodcock.

The Author commenced by explaining the nature of smoke as existing in furnaces, the cause of its formation, its component gases, and the temperature at which they became inflammable, and then pointed out a method of preventing the evolution of opaque smoke, by simple and apparently effective means. It was stated, that ordinary pit coal, under the process of destructive distillation, gave off various volatile substances, some of which were gases, such as 'Hydrogen,'—'Marsh gas,'—'Olefiant gas,'—'Carbonic Oxide,' &c.; these and others existed in the furnace only in a gaseous state, becoming liquid or solid when in the external air, and of such coal tar was composed; and amidst them the carbon, in minute subdivision, was held in suspension, giving to the smoke its sable hue. All these gases were combustible at given temperatures, provided a certain amount of oxygen was present. It was then shewn that the air containing this oxygen, if imparted to the gases after leaving the fuel on the bars, must be administered so as not to reduce the temperature of the gases below their "flame-points." The arguments on the chemical composition of smoke, were enforced by extracts from a letter by Mr. Mansfield, published in the "Mechanics' Magazine,"* in which the subject was fully investigated.

The formation of smoke, or visible carbon held in suspension, was stated to depend entirely upon the insufficiency of the supply of oxygen in the furnace, as the heat of the furnace would cause the various gases to be given off more rapidly than their combustion could be supported, by the quantity of oxygen passing through the fire-bars in the same period of time; this evil being much aggravated by the heat of the air, as usually supplied from the ordinary ash-pit, generally ranging from 200° to 300° Fahrenheit, and the air, at that heat, containing less oxygen by about one-third than at the usual atmospheric temperature, and consequently that the combustion of the fuel to which it was supplied must be one-third less perfect.

The simplest means of preventing the formation of smoke, were shewn to be by providing for an ample supply of oxygen in a condensed state, in the form of cold air, to the fuel on the fire-bars, and by administering such further supply of oxygen to the heated gases, as might be necessary for their complete combustion whilst in contact

* *Vide* "Mechanics' Magazine," October 14, 1854, page 365.

with the boiler, this latter supply being given at such a temperature as would insure the successive ignition of the gases as they were evolved. Thus, by establishing nearly perfect primary combustion, the quantity of smoke evolved was shewn to be reduced to a minimum, of which no visible trace ever reached the summit of the chimney.

The apparatus by which this desirable end was attained was described to consist of two parts, each being the addition of a very simple apparatus to the ordinary boiler-furnace. The first of these was a double set of thin iron bars, lying horizontally in the direction of their length, parallel to each other, immediately beneath the grate in the ash-pit. Each set of bars resembled a Venetian blind in its arrangement; the bars being inclined at an angle of 45° to the horizon in the direction of their width. The bars of the two sets were thus inclined in opposite directions, and being so close together that a vertical straight line could not pass between any adjacent pair of them; yet far enough apart to allow all cinders to fall freely through, and the air to pass freely upwards to the fire. The bars were of the same length as the grate, so as to extend from front to back. It would be perceived that the effect of this arrangement must be to screen the ash pit completely from the heat radiated directly downwards from the grate, and so that scarcely any would pass through by reflection. In fact, not a ray of heat could reach the ash-pit from the furnace, without suffering four reflections from rough iron surfaces, which would leave a mere shadow of a ray for further progress.

Thus a large quantity of heat, which otherwise would be radiated out of the furnace into the ash-pit, thence reflected, and so lost, was saved for the boiler. The ash-pit, also, was only slightly heated by the cinders which fell through; and this source of heat might be reduced to any extent by frequently removing the rubbish from the pit. Another consequence was, that the air passing from below through the grate, not being heated in the ash-pit, entered the fire cold, and therefore not, as it did from ordinary ash-pits, in a rarefied condition. By its coolness, this air prevented, to some extent, the burning of the grate-bars; and, by its unrarefied state, it produced a more intense and rapid combustion of the fuel after it had passed the bars.

Another part of the contrivance was more especially the smoke-burning apparatus. It consisted of a set of tubes, open at both ends, passing through the furnace horizontally from front to back, and terminating within the wall of the front of the bridge; with valves to regulate the access of air into the tubes. The fire-bridge differed importantly from that of an ordinary furnace. It was hollow, and was divided into two parts, the larger of which stood up from below; the other, which was shallower, was in contact with the boiler. Between them all the products of combustion passed from the furnace. The two parts communicated with each other by channels at the sides, and thus formed together an annular chamber. The tubes before mentioned entered the front wall of this chamber, and thus established a communication between its interior and the outer air. The back wall, or plate, both of the upper and of the lower part of this chamber, or bridge, being perforated with numerous holes, opening from the interior of the bridge to the space beyond it, established a direct communication between the outer air and the throat of the flue. There was a second solid bridge beyond the first, descending from the upper side of the flue; this, by interrupting the direct channel through that part of the passage, retarded the flow of the smoke and gases, and caused their perfect mixture with each other within the space between the bridges.

The result of this arrangement was, that a current of highly heated air, which passed through the tubes in the furnace, escaped at the bridge, through the perforations in the back wall, and mixing with the gases from the furnace, which held the smoke in suspension, converted the smoke into flame.

It was contended, that by the adaptation of this apparatus to marine boilers, the high temperature of the stoke holes and boiler rooms would be obviated, and that the steam vessels would not be so evident from a distance as they now were, by the volumes of smoke they gave out; and by having a telescopic sliding funnel, and substituting, during the period of being in action, a horizontal tube, with a small fan blower, any injury to the main funnel would be effectually prevented.

It appeared that the results of this apparatus had been very satisfactory; that at Messrs. Meux's brewery there was not the slightest appearance of opaque smoke from the chimney, and that the money saving, resulting not only from the more perfect combustion of the fuel, but from the use of an inferior quality of coal at a lower price, amounted to full twenty per cent. This success was so great as to warrant the introduction of the apparatus to the more general notice of the profession and the public, through the Institution of Civil Engineers.

The discussion was renewed on the evening of Tuesday last, when it was shown that, although critically precise experiments for determining the amount of evaporation had not been previously made, there was no doubt of the fact of its being possible to use a lower-priced fuel, and to do the full amount of work with the boiler, without evolving any opaque smoke from the chimney; and thus, whilst complying with the requirements of the Legislature, a pecuniary saving could be effected. Recently, however, by experiments on a cylindrical boiler, seventeen feet long by three feet diameter, it had been shown, that 8 9-16ths lbs. of water injected at 42 degrees of Fahrenheit were evaporated by 1 lb. of Newcastle small coal, when Mr. Woodcock's apparatus was in use. It was found, that with small bituminous coal, a better evaporation was maintained than when Llangennoch coal was used, and without any appearance of smoke. The cast-iron bridges of the furnace did not appear to suffer from the effects of the fire; the passage of the air keeping the metal comparatively cool.

As soon as the valves of the apparatus at Messrs. Meux and Co.'s brewery were closed, there was a dense smoke; but on the instant of opening them, the heated gases combined with the oxygen of the air, and flashed into bright flame. Llangennoch coals had been generally used at Messrs. Meux and Co.'s brewery, not from any economy they offered, as they were not so strong as the Newcastle coals, but for the sake of the neighbourhood, as they did not give out opaque smoke; however, with the apparatus described by Mr. Woodcock, small Newcastle slack could be used, and as it could be purchased at fourteen shillings per ton, while the Llangennoch coal cost twenty-eight shillings, there must be a money-saving, and the boilers worked quite as efficiently.

As to the general similitude between the principles advocated by Mr. C. Wye Williams, and those brought into notice by Mr. Woodcock, almost the only difference appeared to be, that the former insisted on the necessity for the coldness of the air admitted, whilst the latter contended for the advantage of heating the air prior to its mingling with the gases. On this point many conflicting opinions were given, and examples quoted. It was, however, allowed, that the arrangement of the Venetian-blind screens below the grate bars, was novel, and was likely to be beneficial in preventing radiation into the ash-pits, and thence into the boiler-rooms of steam-vessels, and there would not be any inconvenience from not being able to introduce prickers from beneath the bars, as good stokers always cleared the bars from above, by the use of the T head tool, and none but idle or bad stokers allowed the clinkers to accumulate, so as to run between the bars, and require the use of the pricker.

The use of heated air was practically contended for, because, when the air was admitted at a low temperature, there was a certain amount of loss from the chilling effect of the stream, or film of air, before it mingled with the gases; whereas this effect was not perceived when the air was admitted at a certain temperature. Under

Mr. Williams's system, this had been attempted to be provided against by multiplying the number and diminishing the individual area of the apertures for admitting air; but it was argued, that by extending the number of apertures still more, and previously raising the temperature of the entering air behind the bridge, the object would be more certainly attained. The system of supplying air at a very elevated temperature under gas retorts, had been very advantageously employed for many years, in conjunction with the hollow bridge, originally introduced by Mr. Farey, the father of the late Mr. John Farey. In corroboration of these views it was stated, that on board one of the "Citizen" steam-boats on the Thames, by a free admission of air, only through a series of parallel wire gauze screens in the fire-door, so as to distribute it in minute jets, the exhibition of opaque smoke had been prevented, whilst a saving of fuel was effected, without any loss of speed, or any extra labour to the stoker. A hollow bridge was also used, and a blast-pipe being extended from the base of the funnel, and opening into the bridge, further beneficial effect had been produced.

A model was exhibited of a hollow cast-iron bridge plate, with a series of vertical ribs, so arranged as to form tubes, leading up from the ashpit to the apex of the bridge, where the air mingled with the heated gases, and passed away in flame. The currents of air up these bridge tubes preserved the iron from destruction, by carrying off the caloric, and it became heated in its upward course.

The introduction of cold air was advocated, on the ground that a mass of air, once broken up into films, or minute jets, would not again unite, but that each particle would pursue its independent course, until it combined with the heated gases. Therefore, the system of admission by the perforated fire-door, so as to pass over the incandescent fuel, had been so strongly advocated.

It was urged that mechanical or other means should be adopted for regulating the proportion of oxygen, according to the state of incandescence of the fuel on the bars. This, it was contended, was virtually accomplished through the side tubes of Mr. Woodcock's apparatus; as it had been shewn that the velocity of the passage of air through the tubes was exactly in proportion with the demand for oxygen by the fuel. That the air was really heated in its passage had been shown by inserting a thermometer, protected from radiated heat, into a flue in connexion with the hollow bridge.

The question of the applicability of most of the systems of preventing the exhibition of opaque smoke was shown to depend, to a great extent, on the area of the fire-grate and the size of the boiler; for if both were restricted, so as to demand an excessively rapid draught, there could not be a sufficient mingling of the gases to insure perfect combustion.

THE VENTILATION OF APARTMENTS AND HOSPITALS.

(Abridged from the *Moniteur*.)

Recent experiments have established that a man of ordinary stature, when in a state of good health, and in a calm attitude, alternately exhales and inhales in one hour from 50 to 75 cubic centimetres of air.* But if the same man be subjected to some strong exertion, so as to emit a larger quantity of air, he will take n at least three cubic metres (about 3ft. 4in.), and breathe out at the most eight or nine cubic metres. The same individual consumes also 11 grammes 0·3 of carbon, the whole forming 271 grammes, in 24 hours, a quantity which, represented by its equivalent in carbonic acid, amounts to 20 or 22 litres in an hour, and 500 litres in one day. The air which we expire contains about four parts of carbonic acid out of 100. Now, as the air in its normal state contains of the same acid four parts in 10,000, we must infer from thence that the carbonic acid exhaled by man is in proportion to the pure air as 400 is to 4, or as 100 is to 1. It is upon the above figures, which are confirmed by the most positive facts, that is grounded the whole theory of ventilation in houses and public establishments. A middle-sized dog consumes a quantity of carbonic acid almost equivalent to that absorbed by a man, and exhales about 18 or 20 litres every hour, thus becoming a deleterious cause of consumption in an apartment of an ordinary size.

But domestic animals are by no means the only cause of vitiation in the air. The latter originates likewise with many domestic habits, such as flowers constantly kept in an apartment, where their speedy withering shows an evident want of oxygen; the perfumed elements for the toilet, the combustion of large lamps, or of numerous candles, as well as the absorption of noxious gases by woollen or silken hangings, when placed against doors and windows.

Thus, when all these things are taken into consideration, it will be seen that if the lower classes, who generally tenant the upper stories of our houses, are not overburthened with children, when also they faithfully adhere to habits of cleanliness, without which the largest apartment soon becomes a focus of infection, they may be in more healthy conditions even than the rich themselves. But, on the other hand, there is an end to salubrity whenever the airing of a room is not completely effected, and when the number of individuals is larger than a small apartment would allow. Thus in Paris, and some other French commercial cities, the lodging-houses at five sous, three, and even two sous a night, are often little better than sinks of impurity; and the police should vigilantly require that the number of beds does not surpass the quantity of air necessary for a normal state of breathing. In a city like Paris, there are but few buildings adapted to procure a sound and refreshing sleep. The owners can only command such lodgings as are totally deficient of a continuous ventilation, and contain in general about three times as many people as they ought to do. The philanthropic spirit which gave rise to infant schools would do well to establish likewise sleeping wards for the poor and working classes.

Inhabited dwellings are always liable to some sort of ventilation, either through the doors and windows, or in consequence of artificial draughts. Let us suppose a place occupying 300 cubic metres, and inhabited by ten persons; the volume of air required for each person will be thirty cubic metres—a quantity absolutely necessary for the regular support of life, particularly if the apartment be closed for a certain number of hours. At the end of eight hours the cubic metre of air will contain 2¼ grammes of carbonic acid; but it will require the constant action of a ventilation affording at least 27 cubic metres, to counterbalance the noxious influence of the gas resulting from the act of breathing, from perspiration, and the very ventilation itself. In hospitals, infant and other schools, workshops, &c., a ventilation of that kind is far from being sufficient; indeed, it ought to be doubled. We are acquainted with certain hospital wards recently built, where every sick person receives at least sixty cubic metres of air per hour, and even that is not enough.

But, indeed, in regard to the latter question, observes an eminent French physician, Dr. Boudin, it has not hitherto been solved in a satisfactory manner. The cause of this non-success is of a complex nature. In some cases the attempts to determine the quantity of pure air to be introduced into such places were made by physicians who were not good natural philosophers; in others, by philosophers who had not enough of the physician within them. As far as the latter are concerned, they appear to have taken too exclusive a view of the vitiation of the air by the carbonic acid which was exhaled, leaving completely out of the question *the mode by which the vitiated air is to be extracted*, when they had to appreciate the

* 50 centimetres = 20 inches, or 1ft. 2-3rds.

quantity of pure air which must be introduced in a given time. Every one will, indeed, easily understand that in a ward where the small-pox or the typhus rages, the danger of breathing such air does not at all consist in the proportion of carbonic acid which the atmosphere may contain. Thus, henceforward, when we have to determine the quantity of pure air allowable to each individual, we must take into consideration the quality of the patient, and the mode of extraction of the impure air. Nay, more—the conditions laid down for contractors, instead of merely stipulating the quantity, must needs determine the quality of the pure air to be introduced into a ward. And, in the meantime, until we arrive at some better system of analysis, it will be necessary to use the eudiometer no less than the anemometer.

Dr. Arnott, whose ideas upon ventilation have been adopted at the hospital of York, prefers to any other means a mechanical force of propulsion combined with the spontaneous draught of a chimney shaft. His system of introducing external air into an edifice, corresponds exactly with that by which the carburetted hydrogen gas runs through the condensed pipes of a city. He simplifies the propelling power by substituting for the steam-engine, the pressure of a column of water, which is alternately introduced and sent back by a plug. The pump which brings from without the air into the edifice is set in motion by a minimum of power, amounting only to one horse, whilst the shaft established in order to ventilate the House of Lords requires a twenty-horse power to operate. The former pump works almost without any noise whatever, and with the greatest regularity, seldom requiring repair. The propulsion of the air through the room where it is warmed, and from thence through the edifice, is far preferable to the method of ventilation by exhaustion, because the former system tends to fill up rather than produce a vacuum, and prevents the regular ventilation from being interrupted by an irregular draught of air penetrating through accidental apertures. But the better an unforeseen irruption of air is prevented, the more does it become necessary to secure a sufficient quantity of air for its object. Now, one of the principal merits in Dr. Arnott's plan is that the propulsive pump, being constructed according to the well-known system of a gasometer, is a precise measure of its own task. Without entering into technical details, let it suffice to say that it supplies 2550 cubic feet of air in a minute, or 135,000 every hour; so that, taking the number of patients in the hospital to be seventy, every one of them would enjoy 1,982 cubic feet of pure air in an hour.

To the above propulsive system, M. Léon Duvoir, a French architect, has substituted one which might be called the *sucking* or aspirative system, which has been adopted by several public establishments in Paris, and among the rest, by the two hospitals Necker and Beaujon. The problem to be solved was the following:—1. To keep up in the wards a permanent temperature of 15 degrees centigrade. 2. To procure, day and night, a minimum ventilation of 60 cubic feet during the cold seasons. 3. To maintain an equivalent ventilation during the night in every other season. 4. To provide every patient with 15 litres of water warmed to the extent of 100°. M. Duvoir has succeeded in the undertaking. He first established a focus or furnace in the cellars, but soon after suppressed it by turning to account the heat of the fire used for medicinal preparations. The external air was brought in by means of reservoirs placed in the garrets, and which offered a large surface, proportioned to the system of general circulation of warm water. Speaking of this combined system of airing and warming at the Necker hospital, the Commissioners named for examining the works express themselves thus:—"The contact of the reservoirs of hot water is sufficient to warm the air in the chimney, and to determine the expulsion of the air from the wards, which is impelled along large shafts or rather sheaths communicating with the main-shaft or chimney. Again, these same sheaths receive the above air from all the vertical chimneys carried along the walls immediately behind every patient's bed. The apertures of these chimneys through which the vitiated air escapes are placed behind each bed, and on a level with the floor. Both in winter and summer the air penetrates into the wards, either through openings in the floor which communicate with the external air, or through a tube likewise corresponding with the central stoves and the ambiant air. In winter the latter, of course, is warm, on account of its previous contact with the tubes for hot water; but it is always kept out of the rays of the sun. This is an indispensable condition, for every one is aware that the solar action from without would prove an obstacle to the free introduction of fresh air into the wards."

The above system of warming and ventilating buildings is now applied to many hospitals, prisons, and churches of Paris; among others we may name the Madeleine and St. Sulpice, the Conservatoire des Arts et Métiers, the Institut, the Imperial Mining Institution, the Institution for the Blind, &c.

PLANTAIN FIBRE.

About forty years ago, the Honorable John Lunan, published in an excellent work, entitled "*Hortus Jamaicensis*," a description of all the indigenous plants hitherto known, as well as of the most useful exotics in this country, from which we extract the following:—

"A great deal has been said and written lately as to the possibility of manufacturing a good hemp from the fibres of the different plants of this genus; and rewards of two hundred pounds have been paid, under an order of the Assembly, for the best specimens produced of this hemp in each county of Jamaica. This is, however, no new discovery; for the Indians have been in the habit, since the first discovery of the New World, and no doubt long before, of making cloth from these fibres. The celebrated circumnavigator, Dampier, notices the process, more than a century ago, as follows:—'They take the body of the tree, clear it of its outward bark and leaves, cut into four quarters, which put into the sun, the moisture exhales; they then take hold of the threads at the ends, and then draw them out; they are as big as brown thread; of this they make cloth in Mindanao, called *saggen*, which is stubborn when new, wears out soon, and when wet is slimy. The natives of the Phillipine islands give the name *abacca* to the vegetable fibres of a species of the plaintain, of which they make their cordage, and of which they have considerable manufactories."

The following is an account of the means made use of for obtaining this hemp, as laid before the committee of the House of Assembly, by Dr. Stewart West, who gained the premium for the best specimen produced in the county of Surry:

MANUFACTURE OF HEMP FROM THE PLANTAIN TREE.

"In order to fulfil the intention of the honourable House of Assembly, I proposed to myself to find out the most simple and expeditious process possible for manufacturing hemp from the plantain tree, that the general adoption of it might not be prevented by complex machinery, or tedious and difficult manipulations.

"I have now to give the result of my inquiries, and have to describe such a simple and easy process as will enable any person to set on foot a manufacture of hemp, without much trouble or expense. The instrument I have employed is so simple, that a carpenter may make it in half an hour, and the whole process is so expeditious, that the hemp may be rendered fit for sale in a few hours after the trees are cut down,—I mean the *undressed* hemp; for to dress it with a heckle, unless it were likewise spun and wove in the country, would be quite foreign to the purpose. The process of heckling is by no means so simple as it appears to be; and I can truly affirm that

if a person, not bred in the business, attempt to heckle flax and hemp, he will convert the greatest part of it into two; besides, different modes of dressing are necessary, according to the manufacture to which the hemp is to be applied. That part of the process, therefore, can be executed better, and to much greater advantage, in Britain. But if the instrument be in good order, and proper attention be paid to the manufacture, the hemp will be rendered so clean as, in a measure, to supersede the use of the heckle, especially for cordage.

"Though the filaments of the plantain tree are naturally large, yet they are divided, and they may, therefore, by dressing, be adapted to the manufacture of the finest fibres, perhaps, to which flax and cotton can be applied. The division of the filaments, however, would be prejudicial in the manufacture of cordage, for it appears, from an experiment of Count Rumford, that the agglutination of the fibres greatly increases their strength.

DIRECTIONS FOR MAKING THE CRAMP.

"Take a plank, six feet long, one foot wide, and two inches thick; set one end two feet deep in the ground, and apply a brace before, to keep it steady; cut a notch on the top, six inches deep and eight inches wide; notch the two uprights half an inch wide, to admit the jaws, which must be made of hard wood, the lower one twelve, the upper twenty, inches long; the lower is fixed, the upper is moveable on a pin at one end, and has a weight suspended at the other, which may be increased or diminished at pleasure. The upright in which the upper jaw turns on the pin may have a mortice, five inches long, in place of a notch, and two inches may be cut off from the other upright. The jaws are half an inch thick, and two inches wide, brought to an edge where they meet, which must be slightly serrated. If the jaws are made of steel, a quarter of an inch in thickness will be sufficient."

PROCESS FOR PREPARING THE HEMP.

"1. Cut the plantain coats into lengths of four feet.

"2. Separate the stems of which the stems are composed, and split the outer coat into ribbons about an inch and a half wide.

"3. Separate the internal parts of the ribbons with a wooden knife, then

"4. Draw them through the cramp till the filaments are clean.

"5. Hang them to dry in the sun as soon as possible.

"When the hemp is thoroughly dry, let it be plaited into pellets, of about half a pound, and tied up into bundles of twenty pounds each."

From experiments tried on the hemp made from the plantain-tree fibre, which was manufactured into rope at Her Majesty's dockyard, Port Royal, the following results were obtained:—

	cwts.	*qrs.*	*lbs.*
King's nine thread inch rope broke by the weight of	6	1	14
Dr. West's specimen	6	2	0
Specimen from the parish of St. Andrew	6	1	0
Ditto, Portland	4	2	0
Ditto, St. George	3	2	0

The above specimens were made of the same size as the King's rope.

It appears, also, from several experiments, that the inside fibres are stronger than the outside, but spun together have a good average strength. This hemp incorporates freely with tar, and its goodness greatly depends in completely evaporating the sap; otherwise the least fermentation greatly impairs its strength; it cannot, therefore, be too thoroughly dried before it is packed for use or for exportation.—*Jamaica Cornwall Chronicle.*

Proceedings of Institutions.

BARKING.—On Thursday week a lecture was delivered at the Mutual Improvement Society, by Mr. W. N. Froy, of Hammersmith, on the "Life and Character of Oliver Cromwell." This was his second engagement by the Society, by whom he is considered a very able lecturer.

DUNMOW.—The members assembled in unusual numbers on the 15th instant, to celebrate the opening of the enlarged Town Hall. The Viscountess Maynard occupied a handsome chair, presented for the use of her ladyship on such occasions by the ladies of Dunmow. An address was delivered by the President, the Rev. C. Lesingham Smith, who congratulated the members on having exchanged their late stinted habitation for the present comparatively spacious and lofty hall, in which their institution might attain to its full development, and discharge all its appropriate functions. The hall itself was a noble monument of their success, and a proof of their prosperity. In the course of his remarks he asserted, that the unanimity existing between all classes with respect to the momentous events now taking place in Europe, was partly to be traced to such establishments as these, which alone enabled the working man to hear of the valour and self-devotion which had been displayed, and the glory which had been won, by his fellow-countrymen. Such knowledge was the just inheritance of every one of England's sons. The meeting was then effectively addressed by several other gentlemen, and concluded with an admirable lecture on "Humourous Characteristics," by George Grossmith, Esq. The military band of the Hon. East India Company played at intervals during the evening, and also for the dancers, who, after the close of the various addresses, kept up the gaiety of the joyous meeting till a late hour.

SEVENOAKS.—On Thursday, the 16th, Mr. E. Mottley, of Margate, delivered an interesting and instructive lecture, at the Literary and Scientific Institution, on the "Chemical Elements of the Munitions of War." Mr. Mottley commenced by introducing several specimens of the early implements of war, leading his audience on to the important discovery of gunpowder. The qualities of nitrogen, its combination and law of definite proportions, were fully and simply explained. Implements of modern warfare were then described—the rifle and Lancaster gun having the greater share of time. This was the seventh engagement Mr. Mottley has received from the Committee of this Institution.

MEETINGS FOR THE ENSUING WEEK.

MON. Actuaries, 7.—Mr. Jellicoe, V.P., "On the relation which should obtain between the amount assured upon lives and the sum reserved, at the expiration of given terms, to meet it."

Geographical, 8½.—1. Mr. Anderson, "Explorations in South Africa, with route from Valfish Bay to the Lake, and ascent of the Teoge River." 2. "Despatches from the Foreign Office, enclosing accounts of the Niger Chadda Expedition, from Commander Miller, R.N., Dr. Baikie, and Mr. Macgregor Laird, F.R.G.S." 3. "Despatches from Acting-Consul Gabriel to Lord Clarendon; also from Commodore Adams and Commander Philips to the Admiralty, announcing the arrival at Loanda of Dr. Livingston, with remarks on the same, by Lieut. Bedingfield, R.N

TUES. British Meteorological, 7.—Mr. F. W. Doggett, "On the relation found to exist between the weather and the crop of hops, particularly in respect to the fall of rain."

Medical and Chirurgical, 8.

Civil Engineers, 8.—Mr. G. J. Munday, "Description of the Coffer-Dams used in laying the pipes from Richmond to Twickenham, crossing the Thames."

WED. Society of Arts, 8.—Mr. P. L. Simmonds, "On various unappreciated and unused articles of raw produce from different parts of the world.

Geological, 8.—1. Captain Brickenden, "On a new species of Pterichthys from Morayshire." 2. Mr. C. Heaphy, "On the Coromandel Gold Diggings in New Zealand." 3. Major Chatteris, "On the geology of the neighbourhood of Nice."

Botanical, 8.

THURS. Royal, 4.—Anniversary.

Antiquaries, 8.

SAT. Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Nov. 17th, 1854.*]

Dated 4th September, 1854.

1936. J. F. H. H. H. de Lavaur, Paris—Waterproof wrappers for packing goods

Dated 8th September, 1854.

1959. S. Frearson, Glascote—Buttons. (A communication.)

Dated 3rd October, 1854.

2118. W. Tatham, Rochdale—Spinning machinery

Dated 10th October, 1854.

2167. J. B. Jackson and W. Bowler, Sheffield—Prevention of smoke.

Dated 14th October, 1854.

2203. L. Monzani, Greyhound place, Old Kent road—Brushes and brooms.

Dated 31st October, 1854.

2310. T. F. Tyerman, Weymouth street, Portland place—Hoop iron bondings.

2314. T. Prosser, Birkenhead—Steam-engine condensers.

2316. A. Craig, Paisley—Railway wheels.

2318. T. Osborne and W. Eldred, Leicester—Stopping railway carriages.

Dated 1st November, 1854.

2320. J. and W. Bradshaw, Blackburn—Time-pieces.

2322. J. B. Robb, Boston, U.S.—Railway brakes.

2324. H. Brinton, Jun., and R. Smith, Kidderminster—Carpets.

Dated 2nd November, 1854.

2326. J. Gedge, 4, Wellington-street south—Grinding machinery. (A communication.)

2328. L. H. Dewey, New York—Means of putting out fire.

Dated 3rd November, 1854.

2332. N. Topp, J. Holt, and J. Partington, Farnworth—Hand-mules for spinning.

2334. E. Alexandre, Paris—Organ-pianos.

2336. W. C. T. Schaeffer, 11, Stanhope-terrace, Hyde-park-gardens—Treating waste wash-waters of mills.

Dated 4th November, 1854.

2338. J. Adcock, Dalston—Application of tobacco-stalk to useful purposes.

Dated 6th November, 1854.

2340. H. Bordier, Orleans—Alcohol from plants of a farinaceous nature.

2342. J. Shaw, Dukinfield—Guns and firearms.

2344. F. R. Ensor, Nottingham—Bobbin-net or twist lace machinery.

2346. W. Childs, jun., Brighton—Pipes and tubes.

2348. F. J. W. Packman, M.D., Puckeridge—Air-gun.

Dated 7th November, 1854.

2352. E. Hogg, Gateshead—Shot and shell.

2354. W. H. Woodhouse, Parliament-street—Water meter.

2356. E. Simons, Birmingham—Candlestick.

2358. J. Bird, Dudley—Reverberatory furnaces.

2360. J. Blackie, Glasgow—Driving-belts, straps, and bands.

Dated 8th November, 1854.

2362. L. Gluckman, Dublin—Electric communications in railway trains.

2364. J. Whitehead, Patricroft—Self-acting mules.

2366. C. W. Siemens, John-street, Adelphi—Electric telegraphs. (A communication.)

2368. W. E. Newton, 66, Chancery-lane—Saws. (A communication.)

2372. C. D. Cranstoun, Elgin—Railway couplings.

WEEKLY LIST OF PATENTS SEALED.

Sealed November 17th, 1854.

899. Moses Poole, Avenue-road, Regent's-park—Improvements in drying and weighing fibrous and other substances.

1140. Robert Oram and William Oram, Salford—Improvements in hydraulic presses.

1141. Charles Bostock and Stephen Greenwood, Manchester—Improvements in machinery or apparatus for cleaning and doubling silk.

1148. Ernest Radigon and Raimond Gabriel de Grimouville, Paris—Improvements in glasses, shades, and smoke plates used in gas and other lighting.

1223. Charles Maschwitz, Birmingham—Improved instrument for paring and slicing apples, potatoes, and other fruits and roots.

Sealed November 21st, 1854.

1144. Frederick Jenks, Handsworth, and Thomas Brown, Birmingham—Improvements in saddle-trees.

1152. John Lawson, 4, Sidmouth-street, Gray's-inn-road—Improvements in the manufacture of cut piled fabrics.

1159. Thomas Clarendon and Owen John Gilsen, Dublin—Improvements in the means or apparatus for working breaks on railway carriages.

1161. Josiah George Jennings, 29, Great Charlotte-street, Blackfriars, and Robert Davenport, Jonathan-street, Vauxhall—Improvements in the construction of kilns for burning pottery and other ware.

1165. Edward Everall and Thomas Jones, 2, Henrietta-street, Brunswick-square—Waterproofing all kinds of cloth, silk, and leather, without injury to their respiratory properties, flexibility of fabric, colour, or appearance.

1169. John Packham, 63, Western-road, Brighton—Improvements in boilers for heating and circulating water.

1177. James Lord, Farnworth—Improvements in the manufacture of articles of ladies' under-clothing.

1191. Joseph Risdale, Minories—Improved means and methods of communication between different parts of ships and other vessels.

1222. Thomas Greenshields, George-street, Derby—Improvements in railway chairs.

1232. Peter Armand le Comte de Fontaine Moreau, 4, South-street, Finsbury—Improvements in the construction of umbrellas and parasols.

1256. David Atkinson, Seaham Harbour—Improvements in printing, and in the machinery or apparatus to be employed therein, or connected therewith.

1330. George Mears, Bell Foundry, Whitechapel-road—Improvements in machinery or apparatus for obtaining sound.

1331. David Clovis Knab, Rue Rosini, Paris—Improvements in the production of carburets of hydrogen.

1398. Joseph Davies, Bristol—Improvements in propelling vessels.

1415. Richard Leicester Antrobus, Birmingham—Improved method of printing oil-cloth for floor and table covers, paper hangings, and other surfaces.

1544. Robert James Maryon, 37, York-road, Lambeth—Improvements in the construction of, and application of, steam-engines for the better means of transmitting motion, and of applying steam or other motive power.

1551. James Derham, Bradford—Improved machinery for combing wool and other fibrous substances.

1554. Elijah Henry Brindley, Longton—Improvements in printing or ornamenting china, earthenware, and glass.

1594. Joseph Barnes, Church—Improvements in furnaces or fire-places.

1756. Thomas Lawrence, Birmingham—Improvements in the manufacture of bayonet blades, and in machinery or apparatus to be employed for that purpose.

1850. Theodore Schwann, M.D., Neuss, Prussia—Improvements in machinery or apparatus worked or actuated by helicals or spirals.

1853. Matthew Curtis, Manchester, William Henry Rhodes, Gorton, and John Wain, Greenacres Moor, Oldham—Improvements in certain machines for spinning and doubling cotton and other fibrous substances.

1872. John Gedge, 4, Wellington-street South, Strand—Improvements in boring instruments known as augers, bits, or gimlets. (A communication.)

1950. George Printy Wheeler, 4, Bellevue-place, Cleveland-street, Mile End-road, and Samuel Bromhead, 38 Holford-square, Pentonville—The production of new fibrous materials capable of and suited for the manufacturing of string, rope, matting, and various fabrics, with or without the combination of cotton, wool, or flax, or for pulp for the manufacturing of paper, papier mache, millboard, &c.

1994. Henry Crosley, Camberwell-grove—Improvements in the manufacture of paper, millboard, and felt from materials not hitherto so used.

2005. George Frederick Evans, Hanover-lodge, Kew-bridge, and Frederick John Evans, Gas Works, Horseferry-road—Improved apparatus to be used in the distillation of coal and other bituminous and resinous substances.

2012. John Ashworth, Bristol—Improvements in sizeing and stiffening textile materials or fabrics.

2013. Nathan Thompson, junior, New York—Improvements in life preserving seats.

3044. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in machinery or apparatus for manufacturing cards employed in the preparation of fibrous materials. (A communication.)

2071. The Honourable James Sinclair, commonly called Lord Berriedale, 17, Hill-street—Improvements in treating, cleansing, and ornamenting paper and other surfaces.

2090. Moses Poole, Avenue-road, Regent's-park—Improvements in cylinder paper machines.

2104. George Fergusson Wilson, and George Payne, Belmont, Vauxhall—Improvements in the manufacture and application of rosin oil.

2114. John Penn, Greenwich—Improvements in the bearings and bushes for the shafts of screw and submerged propellers.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Title.	Proprietors' Names.	Address.
Nov. 18.	3658	Wain's Improved Pulley Block	George Henry Wain	Britannia-terrace, Haigh-street, Liverpool.
	3659	Elbow for Gas, Water, and other Pipes	Samuel Bentley	Birmingham.
	3660	Improved Cricket Bat Handle	William James Page and Edward Joseph Page	Kennington-common.
	3661	Gloves	Brochier Père et Fils	Grenoble, France.